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Incommensurate magnetic fluctuations and Fermi surface topology in LiFeAs

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Abstract

Using the angle-resolved photoemission spectroscopy data accumulated over the whole Brillouin zone (BZ) in LiFeAs, we analyze the itinerant component of the dynamic spin susceptibility in this system in the normal and superconducting state. We identify the origin of the incommensurate magnetic inelastic neutron scattering (INS) intensity as scattering between the electron pockets, centered around the (π,π) point of the BZ, and the large two-dimensional hole pocket, centered around the Γ point of the BZ. As the magnitude of the superconducting gap within the large hole pocket is relatively small and angle dependent, we interpret the INS data in the superconducting state as a renormalization of the particle-hole continuum rather than a true spin exciton. Our comparison indicates that the INS data can be reasonably well described by both the sign-changing symmetry of the superconducting gap between electron and hole pockets and the sign-preserving gap, depending on the assumptions made for the fermionic damping.

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